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NIOSH
Fire Fighter Fatality Investigation and Prevention Program

Death in the line of duty...

A Summary of a NIOSH fire fighter fatality investigation — October 23, 2000

Motor-Vehicle Incident Claims the Life of a Volunteer Fire Fighter and Injures a Volunteer Chief - Virginia

SUMMARY

On December 18, 1999, a 22-year-old male volunteer fire fighter (the victim) died and a 30-year-old volunteer District Chief was injured after the rescue truck he was driving veered off the road, struck an oncoming car and then a tree. The incident occurred while they were responding to a reported gas leak at a private residence. The volunteer District Chief (driver) and a fire fighter (the victim) responded in Rescue 49. While en route, the driver looked down at the dashboard to lower his response priority by shutting off his lights and siren. While doing so, the truck's right side tires dropped off the road surface into a ditch. During the driver's efforts to bring the truck back onto the roadway, he overcompensated, causing the truck to cross the oncoming lane of traffic and strike an oncoming car. Just prior to striking the car, the driver started steering the truck back to the right to avoid a second collision. Due to the momentum of the truck, it struck a tree and flipped onto the driver's side (see Photo 1). Seconds after the wreck, the driver crawled out of his loose seat belt and out of the truck. Several residents called Central Dispatch to report the incident. The driver was taken by an ambulance to a local hospital where he was treated and released. The victim, who was trapped inside the vehicle, was removed and taken to a local hospital where he was pronounced dead. NIOSH investigators concluded that to minimize the risk of similar occurrences, fire departments should

- ***take into consideration the movement required by the driver to reach switches and electronic devices, when developing apparatus specifications***
- ***ensure that all drivers of fire department vehicles are responsible for the safe and prudent operation of the vehicle under all conditions***
- ***ensure that the placement of additional equipment (e.g. radios and map card boxes) added to an apparatus does not interfere with the driver's ability to operate controls***

Rescue Truck Involved in This Incident

The **Fire Fighter Fatality Investigation and Prevention Program** is conducted by the National Institute for Occupational Safety and Health (NIOSH). The purpose of the program is to determine factors that cause or contribute to fire fighter deaths suffered in the line of duty. Identification of causal and contributing factors enable researchers and safety specialists to develop strategies for preventing future similar incidents. The program does not seek to place blame on fire departments or individual fire fighters. To request additional copies of this report (specify the case number shown in the shield above), other fatality investigation reports, or further information, visit the Program Website at

www.cdc.gov/niosh/firehome.html

or call toll free **1-800-35NIOSH**

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- ***consider using mobile data terminals inside the apparatus to aid the driver/operator in finding the exact location of the emergency call***

- ***consider limiting the number of initial responding apparatus to emergency incidents***

INTRODUCTION

On December 18, 1999, a male volunteer fire fighter died and a volunteer District Chief/driver was injured after the rescue truck they were responding in veered off the road, struck an oncoming car and then a tree. The truck overturned onto the driver's side, killing the victim and injuring the driver. On December 20, 1999, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On January 5-7, 2000, a Safety and Occupational Health Specialist, a Safety Engineer, and an Epidemiologist from NIOSH, Division of Safety Research, investigated this incident. A meeting was conducted with the Chief of the department, the Safety Officer, two deputy chiefs, a second-deputy chief, an administrative captain of operations, and the chief of administrative services. Interviews were conducted with the Safety Officer, the driver of the rescue truck, the fire fighters who responded and the Police Officer who investigated this incident. Copies of the vehicle maintenance records, training records, standard operating procedures (SOPs), field sketches, the Crash Team police report, the department's investigation report, witness statements, photographs taken of the rescue truck at the incident scene, and the death certificate were obtained. The incident site and a similar rescue truck were visited and photographed.

The combination fire department involved in this incident serves a population of 261,000 in a geographic area of 446 square miles and is comprised of 504 fire fighters (354 career and approximately 150 volunteers). The rescue truck involved in this incident was a 1991 Mack truck model CF688FC, 4-door, crew cab. The body of the heavy rescue truck, manufactured by Salisbury, was 32 feet long and 8 feet wide. The rescue truck had dual air brakes. The gross vehicle weight was 33,100 lbs. The maintenance records revealed no known problems with the apparatus. The annual state inspection was current and expired in February 2000.

There were no significant weather conditions 48 hours prior to this incident. On the day of the incident, weather conditions were overcast and the road was dry. The driver had a current Class D driver's license. *Note: A Class D driver's license is required by the State Department of Motor Vehicles for any single vehicle with a gross vehicle weight rating (GVWR) of less than 26,001 lbs.* Although the rescue truck weighed 33,100 lbs, the state does not require a commercial driver's license for operators of emergency vehicles.

The rescue truck was traveling on a two-lane residential road in the westbound direction; the lane measured 9 feet 9 inches wide. The eastbound lane measured 9 feet 8 inches wide. The pavement markings consisted of solid double-center yellow lines and white fog lines. The road was asphalt and at the time of the incident was in good condition. It had no drivable shoulder and dropped into a moderate ditch (see Photos 3 and 4). The posted speed limit was 35 mph with an advisory safe speed of 30 mph due to an approaching curve. This road had been identified by the fire department as a dangerous road due to the

insufficient shoulder. Within the past year, there have been four fatalities on this road near the incident site.

Both of the occupants of the rescue truck were wearing seat belts at the time of the incident. The rescue truck was equipped with a 2-point lap belt on the driver's side and a 3-point lap and shoulder restraining belt on the passenger side.

The department requires a driver of an emergency vehicle to successfully complete the department's Emergency Vehicle Operator Course (EVOC) and perform their driving skills under the supervision of an officer before being permitted to drive an emergency vehicle under emergency conditions. This program consists, at a minimum, of 8 hours of classroom training and completion of a cone-driving course. Additionally, the department requires 4 hours of classroom driver training specific to the safe operation of the department apparatus and policies to become a certified driver. The driver had the following driver training: In 1984 and 1989, he completed the National Safety Council Defensive Driving Course, and in 1989 and 1992 he completed the department's EVOC.

The victim had 10 months experience, having completed recruit school in August of 1999 and Emergency Medical Technician (EMT) school in December of 1999. The driver had 10 years of fire fighting experience, and within those 10 years, he had 13 months experience as a certified driver. The driver had limited experience driving this apparatus. He had only driven this unit on four emergency responses in 1999.

INVESTIGATION

On December 18, 1999, a call came into Central Dispatch reporting a gas leak at a private residence. Central Dispatch notified the following companies of this combination department and dispatched them to the scene at 1933 hours: Engine 53, Engine 54, Engine 43, Engine 44, Truck 97, Rescue 49 with a volunteer District Chief/driver, and a volunteer fire fighter (the victim) riding in the officer seat, and a Battalion Chief (BC) driving his unit. *Note: Rescue 49 was en route to the station when the call came in for the reported gas leak. The Lieutenant, originally riding in the officer seat on Rescue 49, remained at the hospital after he had accompanied a patient on a prior Emergency Medical Service (EMS) call.*

As the call was dispatched, the driver of Rescue 49 pulled to the side of the road while the victim looked at a map to find the address given by Central Dispatch. The victim found the address listed in the index; however, he could not find the exact location on the map. The BC pulled his unit behind Rescue 49 to find the location of the address on his map. Once the BC located the address, he pulled in front of Rescue 49 and proceeded to the incident. Since the driver knew the general area of the address, he marked Rescue 49 en route and proceeded with priority 1 conditions (lights and sirens).

The victim continued to look for the exact location on the map. Due to heavy traffic, the BC's unit and Rescue 49 were separated from each other. While Rescue 49 proceeded to the call, the driver and the victim were discussing the exact location of the address. *Note: Through the interviews conducted, it is believed that the driver was also looking at the map to help the victim find the exact location.* Still not able to locate the address on the map, the driver decided to reduce to priority 3 conditions (normal driving conditions).

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All units, except Rescue 49, were on the scene. The driver noticed there was very little radio traffic. To reduce his priority, the driver looked down at the dashboard and reached over to cut the lights off, via the master switch. *Note: The master switch, located on the dashboard between the driver's and officer's seat, is 23 inches from the center of the steering column. The driver had to reach up and over a metal 8-inch by 12-inch map card box (see Photo 2).* As the driver looked down at the dashboard area to find the master switch, he reached over to the right, with his left hand still on the steering wheel. *Note: The driver's arm length was insufficient to reach the controls without leaning while in the seated position. It is undetermined whether the driver inadvertently pulled the steering wheel to the right while he was reaching for the master switch or if the rescue truck followed a straight path instead of following the slight curve of the road.* The rescue truck's right front and rear dual tires dropped off the road surface, into a ditch and concrete culvert pipe (see Photo 4). The rescue truck traveled across an asphalt driveway and back into the ditch. The driver put both hands on the steering wheel and let off the accelerator. The police department analyzed the arc of the tire marks, determining a radius and the critical speed scuffs. They determined that the rescue truck lost control after leaving the driveway (see Photo 4). After the vehicle lost control it was determined that it was traveling approximately 51 mph at the time it came out of the ditch line and back onto the roadway. The driver tried to bring the truck back onto the roadway, however, he overcompensated, crossed into the oncoming lane of traffic, and struck a vehicle heading eastbound (Vehicle #1). Before impact with the oncoming vehicle (Vehicle #1), the driver steered the rescue truck to the right, attempting to avoid a second collision (Vehicle #2). It is estimated that the rescue truck was traveling approximately 45 mph at this point. After impact with Vehicle #1, the truck crossed back into the westbound lane, went off the road surface and hit a large tree (see Photo 5). *Note: The police department determined that the truck's weight shifted to the driver's side as the truck struck the tree. This weight shift caused the truck to overturn onto the driver's side. The speedometer of the rescue truck was analyzed and it was determined that the rescue truck was traveling approximately 55 mph at the time of impact with the tree.* Vehicle #2, traveling eastbound behind Vehicle #1, ran off the road to avoid hitting the rescue truck. Both Vehicles #1 and #2 ran off the road and into the eastbound ditch; however, none of the occupants were injured. Several residents who heard and saw the collision of the rescue truck, called 911 to report the motor-vehicle incident. Immediately after the collision, the driver crawled out of his loose seat belt and out of the cab through the shattered windshield. The victim was suspended by his seat belt, and was hanging over the center console. Between 1944 and 1951 hours, the following units were dispatched to the motor-vehicle incident involving the rescue truck: Engine 43, Engine 44, Engine 53, Engine 54, Engine 93, Truck 97, Ambulance 422, Ambulance 731, Ambulance 736, BC 1, BC 2 and BC 4. An off duty fire fighter/paramedic was several cars behind the wreck in a privately owned vehicle when he approached Rescue 49 and saw it overturned on its side. The fire fighter/paramedic ran to Rescue 49 and saw the driver by the front of the truck. He asked the driver who else was on the apparatus and the driver replied that the victim was inside the vehicle. The fire fighter/paramedic climbed on the passenger side of the truck and saw a civilian holding the victim's head. The fire fighter/paramedic did a quick assessment of the victim and noticed that he had a very weak pulse and agonal respiration. He noticed the victim had extensive head trauma and his legs were pinned

under the dashboard. Engine 53 arrived on the scene at 1945 hours and the Lieutenant assumed incident command (IC). The fire fighter/ paramedic relayed the condition of the victim to the IC. At 1946 hours, Truck 97 arrived on the scene. The Lieutenant from Truck 97 approached Rescue 49 and was told the condition of the victim. The IC told the Lieutenant from Truck 97 to begin the extrication procedure and at 1951 hours requested from Central Dispatch an additional engine and a medical helicopter. The Lieutenant climbed on top of the passenger side of Rescue 49 and tried to release the victim's seat belt; however, he could not reach it through the opening on the passenger side. With a knife, the Lieutenant cut the seat belt to free the victim. Due to the crushed cab, the victim's upper body only moved approximately 2 inches once the seat belt was cut. The Lieutenant requested spreaders to separate the vehicle's "A" (front pillar area where the front door is connected to the body) and "B" pillar (the pillar between the front and rear doors) which were approximately 2 inches apart. Once the "A" and "B" pillars were separated, the dashboard area pushed out approximately 20 inches and the victim slid out of his seat. The victim was loaded onto a backboard and placed in an ambulance. Because the victim's condition was not stable, he was taken to the hospital by ambulance at 2005 hours where he was later pronounced dead.

CAUSE OF DEATH

According to the death certificate, the cause of death was atlanto-occipital dislocation (severe neck spinal cord damage) resulting from motor-vehicle violence.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Fire departments should take into consideration the movement required by the driver to reach switches and electronic devices when developing apparatus specifications. [1]

Discussion: The cab design is a very important factor for the safe operation of a fire apparatus. Controls which the driver must use with a blind reach should be placed directly in front of the driver, or above, at shoulder level. The driver of the rescue truck had to momentarily take his eyes off the road while he looked down at the dashboard to turn off the master switch. The driver's arm length was insufficient to reach the controls from the seated position, causing him to reach to the right. If existing controls are too cumbersome for drivers to operate without taking their eyes off the road or having to overextend their reach, a passenger riding in the officer's seat should operate the controls. Additionally, consideration could be given to using a different shape or texture for the main switch (e.g., the main switch is round and all others are square shaped) when a blind reach is necessary. This would provide drivers with an alterative means to find the correct switch without having to take their eyes off the road.

Recommendation #2: Fire departments should ensure that all drivers of fire department vehicles are responsible for the safe and prudent operation of the vehicle under all conditions. [2,3,4]

Discussion: Fire departments should ensure driver/operators of fire service vehicles are familiar with the hazardous routes (e.g. insufficient shoulder) they travel and always maintain a safe speed. The department's standard operating procedure for apparatus operation states, "when operating fire department apparatus under less than favorable conditions (e.g. bad roads, heavy traffic, slick roads, etc.), the posted speed limit is the absolute maximum permissible. However, when driving under favorable conditions (e.g. light

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traffic, good visibility, etc.) the maximum of 10 mph over the speed limit is authorized." The speed limit for this road was 35 mph with a cautionary safe speed of 30 mph. The police department estimated that the rescue truck was traveling approximately 51 mph when it exited the ditch.

Recommendation #3: Fire departments should ensure that the placement of additional equipment (e.g. radios and map card boxes) added to an apparatus does not interfere with the driver's ability to operate controls.[1]

Discussion**:** When departments add additional equipment to an apparatus, they should consider if it will obstruct any controls the driver must operate. The department installed a metal 8-inch by 12-inch map card box in the center console of the rescue truck (see Photo 2). The driver had trouble reaching up and over the box to operate the master switch.

Recommendation #4: Fire departments should consider using mobile data terminals inside the apparatus to aid the driver/operator in finding the exact location of the emergency call.

Discussion: Many fire apparatus are equipped with mobile data terminals to provide additional information while en route to a emergency scene, providing the officer with the location and further information on the incident to which they are responding. A Global Positioning System (GPS) could also help Central Dispatch determine the location of the emergency scene in relation to the location of the responding apparatus.

Recommendation #5: Fire departments should consider limiting the number of initial responding apparatus to emergency incidents.[3]

Discussion: The department's pre-incident response plan for a reported gas leak called for two engines and one rescue truck. However, since several pieces of apparatus were returning to their stations, five engines, one rescue truck, one aerial truck and one Battalion Chief were dispatched to the scene. While en route, the driver of the rescue truck decided that he could lower his priority since all units were on the scene and there was very little radio traffic. By reducing the number of responding pieces of apparatus or only dispatching the predetermined units, it could reduce the overall amount of exposure for a motor-vehicle incident.

REFERENCES

1. Human Factors Engineering an Expanded Checklist for Fire Apparatus and Equipment Design. [1964]. Prepared for Contract OCD-PS-64-43, With the Officer of Civil Defense.

2. National Fire Protection Association [1997]. NFPA 1500: Standard on fire department occupational safety and health. Quincy, MA: National Fire Protection Association.

3. Virginia Fire Department. *Written Standard Operating Procedures. Driving Policy #1.*

4. Virginia Legislative Title 46.2-852-Motor Vehicles Q Subtitle 46.2-100 R General Provision; Department of Motor Vehicles. Chapter 8 - Regulation of Traffic - Article 1 General and Miscellaneous.

INVESTIGATOR INFORMATION

This incident was investigated by: Kimberly Cortez, Safety and Occupational Health Specialist, Eric Schmidt, Safety Engineer, and Tony Fabio, Epidemiologist, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH.

Photo 1. *Rescue 1 After Impact With the Tree.*

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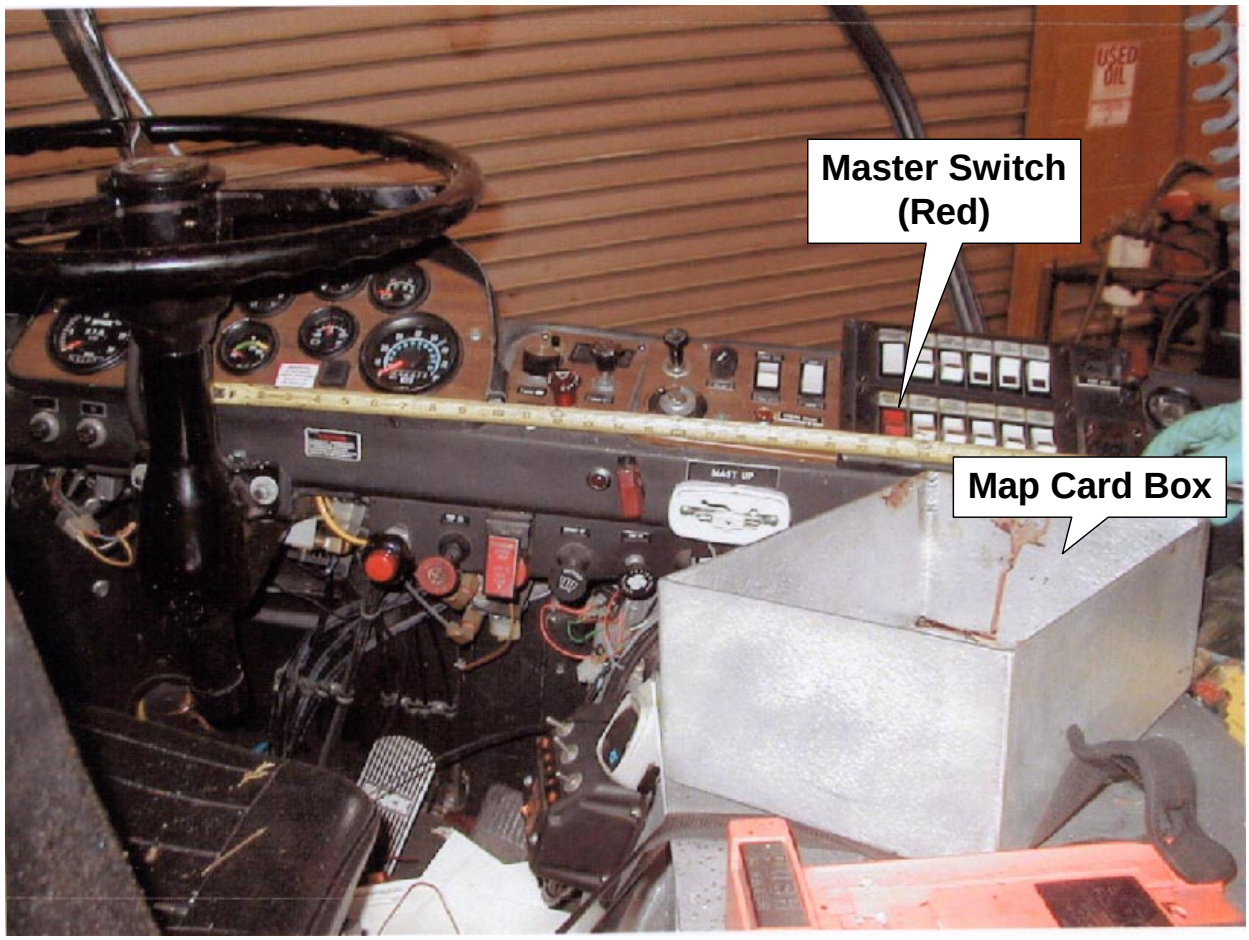

Photo 2. *The Map Card Box and the Master Light Switch Inside the Cab.*

Photo 3. *Incident Site.*

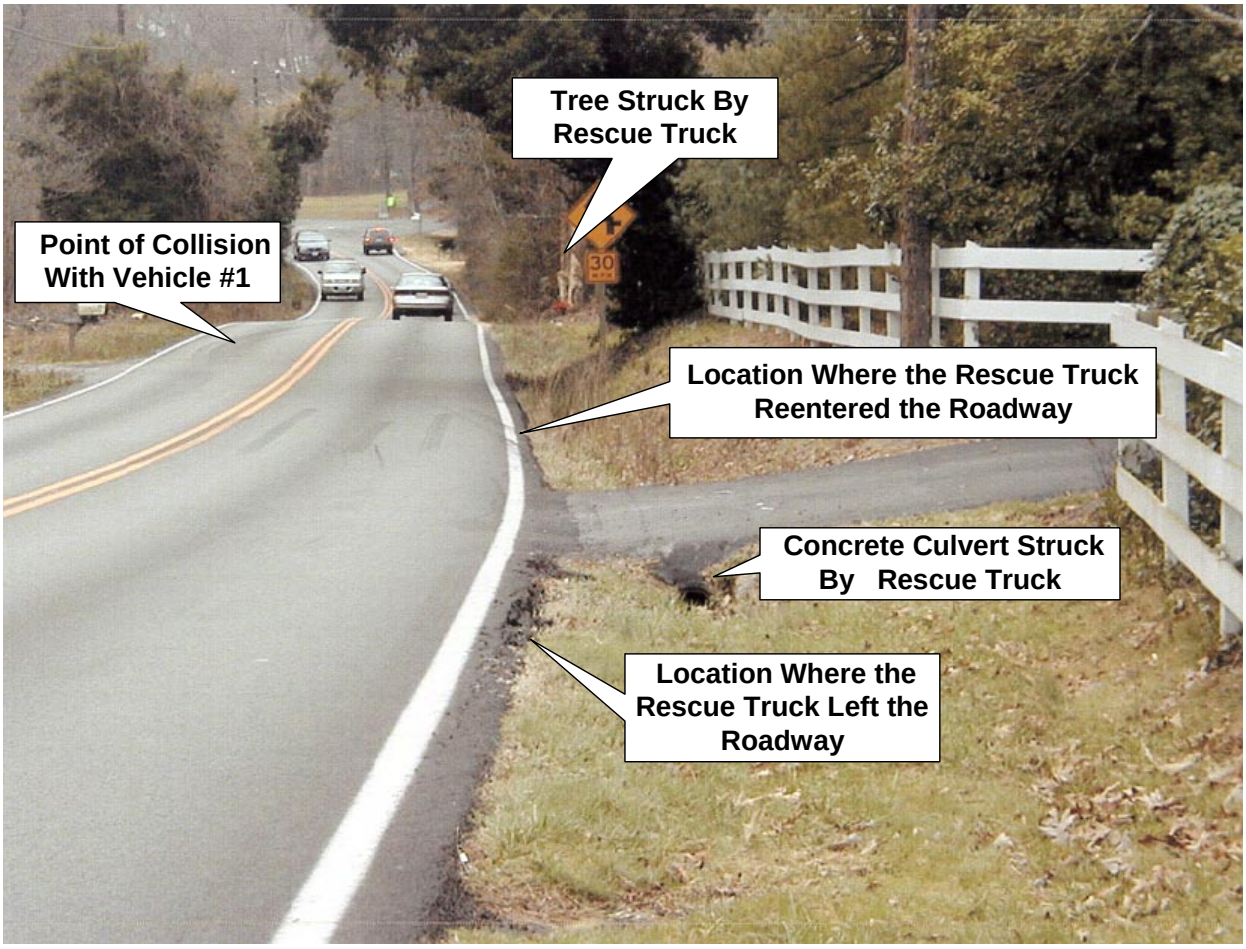

Photo 4. *Incident Site.*

Photo 5. *The X Indicates the Point of Impact of the Rescue Truck With the Tree.*